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SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Espy's Experiments.

PROFESSOR FERREL's letter in *Science* of Oct. 3 emphasizes some of the points that I have insisted upon in regard to the distinction which should be made between meteorologic facts and theories. Professor Ferrel clearly sets forth the fact that such theories depend upon "physical constants," such as "the mechanical equivalent of a unit of heat, the specific heat of air, the latent heat of aqueous vapor, the tension of the aqueous vapor of saturated air at any given temperature," etc. I have tried to show that starting from such facts, and elaborating a theory which shall account for such complex motions as we meet with in our storms, is certainly very interesting; we do not agree, however, as to whether it is profitable or not. That the results of Espy's experiments do not enter into modern theories will be a surprise to some, I think. I have tried to show that no one, so far as I knew, had tried Espy's experiments or shown that they could be applied to storm conditions as they are now familiar to us. Of course, a score of physicists, more or less, have theorized upon the subject.

May I suggest that I have never contended that latent heat is not set free on condensation of moisture? My whole effort has

been to determine the sufficiency of Espy's experiments in establishing the view that there is an uprush of air in our storms, which is increased by the liberation of latent heat from condensation, etc. It seems to me that if all other views regarding his researches prove faulty, the single fact that he used an expansion which was equivalent at times to a rush of air at ten thousand feet per second,—an absolutely incredible velocity for our uprushes,—would be well-nigh fatal to his deductions. In repeating Espy's work, I simply attempted to carry on a research which should in some measure be comparable with natural phenomena. Expansions at the rate of five hundred and a thousand feet per second are certainly far greater than any that we can consider as occurring in our storms. I hope shortly to repeat my experiments with improved apparatus, and determine, if possible, a few points in Espy's work that are not quite plain. Professor Ferrel himself shows that these very researches of Espy were faulty, and this corroborates in some measure my results.

Finally, Professor Ferrel calls attention to the deduction that I have made, that compressing air ten inches, without the loss of heat, would heat it 163°, and gives 43° as the true temperature. My deduction was based upon the facts presented by Professor Tyndall on the sixty-sixth page of "Heat as a Mode of Motion." I find I have mistaken Tyndall's meaning. This computation does not seem very simple. One of my friends, a physicist, gives me a very different value from Professor Ferrel's. The simplest computation would be in the case of a cooling after a compression, and after the compressed air has attained the outside temperature. I feel sure, that, if Professor Ferrel will make that computation, he will see at once that his temperature of 45° cannot be correct. The problem seems quite complex, and I would be very glad to have some one familiar with such problems work out a solution. The problem is this: What will be the rise in temperature in a mass of air at atmospheric pressure if its pressure is increased without the loss of any heat; the increase of ten inches to be considered after the air has cooled to its initial temperature? May I call Professor Ferrel's attention to a single point which he seems to have overlooked, or regarded of little importance? It is this: if we consider that Espy, after compressing the air, waited until it attained the outside temperature before explosion, the resultant cooling after expansion cannot be compared in any way directly with the heating produced by compression and without the loss of heat. Moreover, it is impossible to determine, by Espy's work, the amount of the previous heating, from the cooling after explosion.

H. A. HAZEN.

Washington, Oct. 4.

Deaf-Mutes and their Instruction.

BY a deaf-mute is understood one who is born deaf, or lost his hearing before the acquisition of speech, and in consequence thereof is mute. Deafness may be divided into two classes; viz., congenital and acquired. Acquired deafness admits of four subdivisions:—

A. Where hearing has been lost before the acquisition of speech.

B. Where vowel hearing alone is retained.

C. Where the hearing has been lost after the acquisition of speech, but the latter imperfectly retained.

D. Where the hearing has been lost and speech retained, but the individual lacking education, and precluded from training in common with hearing children.

Those described under C and D are designated as "semi-mutes." Over fifty per cent of the total number of deaf-mutes are of the acquired form. Children who lose their hearing at the age of three or four years are apt to forget speech within about a year's time, unless intelligent parents endeavor to retain and cultivate it. The hearing is more essential to intellectual development and enjoyment than any other sense. Without education, a deaf-mute is entirely debarred from the acquisition of spoken language, the noblest product of the mind. It is true, necessity, the mother of invention, impels one thus affected to invent a language of natural signs to communicate with his fellow-beings; but he is not enabled to express or receive abstract ideas through this medium.

Intercourse under these circumstances is necessarily limited. The absence of hearing power makes the individual more dependent upon his other senses, which consequently acquire a high degree of development and acuity by constant practice. Sight, touch, and general sensation take the place of the lacking sense, in addition to performing their inherent physiological functions, in the acquisition of mental training and knowledge. Observers will note that the gaze of the deaf-mute wanders from object to object, interrogating them as to their significance. The conclusion drawn from such an inspection depends for correctness upon the reasoning faculties and intellectual vigor of the individual. In general, the uneducated deaf-mutes recognize a difference between right and wrong; not the moral right and wrong in the full sense of the expression, but sufficient to enable them to evade coming in conflict with the law. They are able to perform mechanical labor, and try to make themselves useful. In earlier times, when they were not recognized as responsible beings, they were sometimes employed at services where secrecy was desirable, as the law did not recognize them as witnesses, even in their own behalf. As a consequence of frequent misunderstandings with their fellow-beings, they are apt to become quick-tempered. Some drag and shuffle their feet in walking,—a habit due to their infirmity and the want of education. The general sensation of deaf-mutes is very acute; and it is very seldom that we hear of a deaf-mute being run over by vehicles, or meeting with kindred accidents, in this great metropolis. Their manners, morals, and understanding will depend largely upon their associates. Despite the fact that uneducated deaf-mutes have given evidence of a high order of intelligence, they were not recognized as rational beings by the ancients, and were classed with idiots. Our progenitors did not understand the connection between hearing, speech, and thought; and the deaf-mutes were denied the capacity of intellectual culture, and were allowed to remain in a deplorable state of ignorance. The first intimation to be found regarding the instruction of this unfortunate class occurs in Rudolph Agricola's works, "*De Inventione Dialecticæ*." This writer flourished during the close of the fifteenth century. He relates the case of a deaf-mute who could converse by writing. From the sixteenth to the seventeenth century quite a number of cases of deaf-mutes who were educated individually are recorded, some by means of the sign-language, and others by articulation. J. P. Bonnet taught deaf-mutes by articulation, and published his method at Madrid in 1620.

The credit for establishing the first school for deaf-mutes belongs to De l'Epée. This school, established at Paris in 1760, became a state institution in 1791. While this was a momentous step forward in the history of deaf-mutism, the founder unfortunately made the sign-language the basis of his instruction. His idea was, that spoken language is foreign to the deaf-mute, because he cannot acquire it through the same channel as we do (by hearing), and that his natural language is one of signs, because he uses them; and therefore De l'Epée's system develops from the natural signs, which necessity compels the deaf-mute to use, an artificial sign-language, which has no analogy in construction with spoken language, and imparts to the deaf-mute all information in that artificial sign-language, and makes the acquisition of his native language a secondary achievement, as we, for instance, learn a foreign language by means of our mother-tongue.

In 1778, Heinricke opened a school for deaf-mutes in Leipzig, and made articulation the basis of instruction. Since that time these two systems have been in vogue, and are designated, after their origin, the French and the German system respectively. The German system approaches in principle to the method of nature. A child is made to acquire language by frequent representation of the word to its mind through the sense of hearing. To overcome this obstacle in the deaf child, the word is exhibited to him through the sense of sight, and in a twofold manner,—by articulation and by writing. The word is thus ingrafted upon the mind by two impressions without the intervention of any artificial signs. As a consequence, those taught by articulation share as fully in the possession of a mother-tongue as their more fortunate brethren, excepting that this end is obtained at a somewhat later period in life. They employ it in reflection; and it is

the language they dream in (they speak in their dreams as normal individuals), for they are unacquainted with any other. Those taught by signs reflect by means of signs, and translate their impressions into our language when necessity compels them to. Even De l'Epée acknowledges this latter fact.¹ For the benefit of those who are unacquainted with the method of teaching deaf-mutes to speak, I will give a brief illustration. The easiest sounds to begin with are the vowels *a*, *o*, *u* (*a* as in *father*, *o* as in *hold*, and *u* as in *flute*). The teacher writes the letter *a* on the black-board, and the child copies it. The pupil then places his hand on the teacher's chest while the latter is in the act of pronouncing the letter. By this means the pupil feels the expiratory thrill caused by the articulation of the letter, and will further note that the tongue lies flatly upon the floor of the oral cavity, and that the mouth is open. The child will have very little difficulty in pronouncing the letter; it may occasionally be necessary to depress his tongue once or twice. The pupil is then caused to place his hand upon his own chest, and repeats the letter. By feeling the vibration, he becomes conscious of the fact that he has accomplished the feat. The letters *o* and *u* are pronounced with visible modifications of the position of the lips.

In *m* the lips are slightly closed, and the air passes in a vibration through the nose. By placing the forefinger of the pupil against the nostril, he will feel the letter as it is pronounced. After a few attempts, he will readily succeed in enunciating the letter himself. In *f* the tip of the tongue rests against the upper part of the lower gum; the upper teeth rest lightly upon the lower lip; and the lips are lightly closed excepting at the centre, where a small opening is preserved, through which the air hisses. If the pupil holds the back of the hand a little distance from the mouth, he will feel the letter as it is pronounced. He will easily learn to pronounce the letter after one or two endeavors. By holding his hand before his own mouth, he perceives whether he pronounces the letter correctly or not. In *v* the upper teeth rest lightly against the lower lip, and the air passes through them. By holding the back of his hand under the chin, the pupil will again feel the letter pronounced. In *s* the tip of the tongue rests against the upper gum, the teeth are closed, and the air hisses through them. The pupil will learn to pronounce the letter at the first attempt.

Now, some may consider this to be a very slow process, which exhausts the patience of both teacher and child; but let me say, as one familiar with the subject, that this is not the case. With a little experience on the part of the teacher, a class of ten or twelve congenital mutes of ordinary intelligence will acquire the entire alphabet within ten or twelve weeks, and will be able to read from the lips, and speak and write such monosyllabic words as "book," "fan," "hand," "mouth," "cap," "fish," "hat," "house," "cup," "man," etc. At the expiration of the first year they will be able to make use of simple sentences. Even though the voice of some congenital mutes may not be as pleasant as that of others, the labor expended is not lost; for such have the advantage, first, of being able to read from the lips whatever is spoken; and, second, the value of the impression which has been made upon the mind by articulating the word. I need scarcely say that all this is more readily acquired by semi-mutes, and that their voices sound more pleasantly to the ear. We should, moreover, consider the injustice which has been and is now practised against the semi-mutes, and they constitute a large percentage. By those schools which make use of the sign-language, they are classed with congenital mutes, who employ only signs in communicating with one another, and naturally the former do not find opportunity for retaining what speech they may have possessed. Sometimes even the teacher is a mute. Under these circumstances, and as if designedly, the semi-mute is bound to forget speech, especially after he has acquired the sign-language; and finally he becomes so imbued with muteness, that he actually becomes ashamed to use his voice. I have had the opportunity of observing the effect produced upon semi-mutes, when brought to an institution where signs were used. For a while they could not recover from their bewilderment and confusion when they,

¹ See my article on "Deaf-Mutism: Its Pathology, Causes, and Treatment," in the New York Medical Record, Nov. 3, 1888.

viewed their surroundings, and noted the inmates making faces, throwing their hands and arms up and down, forwards and sideways, and they themselves utterly oblivious to the meaning of these pantomimes. The effect is as if a sane man were suddenly put amidst a crowd of lunatics. Several highly educated teachers, who were connected with a school for deaf-mutes where signs were used, acknowledged to me the fact that there has never been a congenital deaf-mute educated in this country by the sign-language who could use the English language correctly. All those who are paraded at exhibitions are semi-mutes, who had a fair knowledge of language when they were brought to school. If those advocates of the sign-language who claim that a succession of gifted and philosophic men have improved the methods of educating deaf-mutes would only have retained and cultivated the speech of the semi-mutes intrusted to their care, they would have merited claim for earnestness and sincerity of purpose; but these are, and always have been, the very ones to fiercely combat every honest attempt to improve the mental condition of this unfortunate class. A very able opponent of the sign language very truly said, "Different views may be harmonized, but different motives never." The sign-language obtained a foothold in this country merely through accident. Its exponents have sprung from one family here, who are so deeply indoctrinated with the fallacious cult, that self-interest and obstinacy prompt them to make a combined stand against reform. Nevertheless, since the Institution for the Improved Instruction of Deaf-Mutes in this city, and the Clark Institution at Northampton, Mass., came into existence (now a matter of over twenty years), where all the branches of an education are imparted in articulated speech with success, the sign-language began to decline. It is true, it dies hard; but the sooner this end is obtained, the better it will be for all concerned. Rest to its ashes!

In the "Reference Handbook of the Medical Sciences," Professor E. M. Gallaudet, Ph.D., LL.D., contributed an article on the language of signs and the combined systems of instructing the deaf-mutes. The greater part of the article is devoted to demonstrating the fact that such a thing as a sign-language really exists, and contains historical notes and narratives, evidently cited with a view to proving its origin and varying fortunes. Remarkable! The learned professor might be surprised to find, on consulting any competent lexicon, that there exists, besides, a language expressed with the eyes, one with flowers, one by means of music. The click of the telegraph-instrument is a most useful mode of communication. Thieves use a language expressed with the fingers, eyes, and feet, etc. All of them have been and are made use of by hearing people with more or less utility and practicability. But articulate speech is pre-eminently the language of the human race, alike for the hearing and the deaf. The various substitutes which human ingenuity has invented are the outcome of peculiar circumstances. The hearing child makes use of gestures before it acquires speech, as a matter of necessity; the intelligence of the child determines the expressive value of the gesture; and the same is true of the deaf-mutes. In summing up the advantages of the combined system, the writer says,—

"The experience of nearly a century and a half of practical instruction of the deaf has established no conclusion more clearly than that it is impossible to teach all deaf-mutes to speak. Some are found to be lacking more or less in mental capacity; some have only a weak and inefficient imitative faculty; with others an infirmity of vision is discovered; others, again, have little quickness of tactile perception."

It may have taken some specially constituted instructors to come to such a conclusion; it may be said with equal justice that "a century and a half of experience" has proven conclusively that it is impossible to teach all hearing children to speak or to write correctly or intelligently. Any intelligent layman knows that a lame child may also be near-sighted, and that one thus afflicted will make neither a good foot-racer nor an expert hunter. All hearing people are surely not on the same plane of intellectual, physical, and moral vigor; for, if they were, such inadequate means of instructing the deaf as the sign-language would never have found favor.

"In former times these doubly or trebly defective children were

summarily dismissed from oral schools with the unjust and inhuman condemnation that they were imbeciles; and even at the present they are quietly dropped from such schools under one pretext or another, because the oral teachers are perfectly well aware that they cannot be educated under their method."

Even the intelligent congenital mute cannot get a fair education at a school where the sign-language is used as the basis of instruction, much less the feeble-minded ones. I admit, those feeble-minded ones are retained at those schools at three hundred dollars a year, as a matter of pecuniary interest only.

"The essential defect in the oral method is, then, that it practically rejects a large proportion of the deaf as incapable of education; that it fails with those who stand in greatest need of a helping hand."

Mind, that cannot be impressed with the meaning of a word, expressing abstract thought by articulation and by writing, can neither be impressed with the meaning of an artificial sign.

Dr. Gallaudet admits that "the radical deficiency of the manual method is, that it makes no provision for imparting the extremely valuable accomplishments of articulation and lip-reading to the large percentage of the deaf that is certainly capable of acquiring these great gifts." The radical deficiency of the manual method, in better words, is, that it is a failure as a means of instructing congenital mutes, and that it perpetrates a gross injustice upon the semi-mutes, in that it renders them dumb.

"The doors of the combined-system schools are wide open to *all* the deaf,—to the weaker as well as to those more richly endowed with capacity for improvement. In these schools no method or appliance is rejected that can be shown to be of practical help to any number, however small, of the great class of the deaf." If this were true, those schools should have established separate classes or schools for the semi-mutes,—an innovation so far never even attempted.

"He who would assume the responsibility of advising parents as to the most desirable course to be pursued in the education of a deaf child should never forget that to teach such a child to speak comes very far short of educating him." How considerate and unselfish!

"In oral schools there is a strong tendency to lay the stress and emphasis of the work of instruction on speech; and to secure success in this, many matters of greater importance to the pupil are sacrificed, for, in spite of the zealous assurances of promoters of oral teaching that speech is an inestimable boon to the deaf,—the thing of paramount importance,—it remains true that there is not one of the main objects sought to be accomplished in the general education of the deaf which will not be seen, with a very little reflection, to be of more consequence to a deaf child than the mere ability to speak and to read from the lips of others."

If the above is not a wilful misrepresentation, it betrays, certainly, ignorance of the subject under consideration; for, after a class of congenital mutes has mastered the mechanism of articulation which is completed within the first year, instruction goes on as in a school for hearing children.

"To be able to read and write intelligently, to possess the knowledge that is imparted in common-school training, to be master of a trade by means of which one may gain a livelihood, to be well grounded in principles of morality, to enjoy an abiding faith in God and a hope of immortal life,—surely each one of these, weighed over against a mere ability to speak, would be found of far greater value to the deaf."

Congenital mutes who are educated by means of the sign-language can hardly acquire a trade in common with the hearing, for the reason that they cannot express themselves intelligently by writing; and their artificial signs are not understood, and certainly look ridiculous, especially to the illiterate; while those taught by articulation do not meet with these obstacles. To cover the failure of their system of signs, those schools were compelled to open workshops in connection with their schools. The religious training of the pupils in those schools cannot be so thorough where the knowledge of language is so meagre.

"The achievement of imparting speech to one who has it not comes so near to being a miracle that one is dazzled by the brilliancy of the triumph, and is apt to feel that every thing else in

the education of the deaf must be subservient to this. Parents and friends of the deaf need to be placed on their guard against this grave error, and to be advised that those schools and systems best deserve their confidence and support that seek to give the broadest and most valuable education possible to *all* the deaf."

After what has been said, the conclusion which the unbiassed will be forced to is, that the combined system, which consists of the sign-language as the basis of instruction, and, in addition, as a side-show, pretends to teach articulation, is a farce, which serves to mislead parents and friends of the deaf; and that the language of signs, instead of being a stepping-stone, is a hinderance to deaf-mutes in the acquisition and in the use of spoken language.

B. ENGELSMAN.

New York, Oct. 8.

Another Magnetic Man.

My attention has been called to the following account from a Lewiston paper, dated Sept. 25, of a scientific phenomenon in which your readers may be interested.

"The writer was entertained Friday evening by a wonderful man, a resident of College Street. The gentleman is a well known citizen of most trustworthy character. After an evening's performance he feels exhausted in the morning. He can do nothing with the palms of his hands on the object, but must use the tips of his fingers only. He first began with a common table with swinging sides. Placing his fingers nearly in the centre, he could cause either end to rise and remain suspended. It would rock, beat time to music, or turn a complete somersault. No part of his person touches the object but his finger-tips; and there are no secret wires, for we examined the table carefully. Next he let down the swinging sides, which are on hinges, and, by placing his finger-tips, could raise the leaf, and hold it in that position several minutes while we tried to pull it away from his fingers. Then we took a heavy braided rug, and folded it in four thicknesses, and placed it on the table. With this obstruction he easily lifted the table, and turned it completely over. A plate was put upon the table, and this proved no hinderance. Then a tin dish inverted was given to him, and still the table not only came up, but the tin dish stuck fast to the table. He lifted chairs and other objects while resting. Then the table was inverted; and, placing his finger-tips upon the table-legs, the heavy table came up, and remained clearly suspended from the floor, with one foot of clear space beneath.

"The writer then sat upon the end of the table, which came up so suddenly as to throw him off upon the floor. At last came a strong test. We seated ourselves in chairs at opposite sides of the table, the writer grasped the table-legs with all his strength, and the gentleman stood clear of the table, and, placing only his fingers upon the smooth surface, drew the table so violently as to bring us down upon the floor in confusion.

"Finally we grasped hands and tested our natural strength in pulling, and the writer was the stronger man; but, as the current came down in his arms, it went up into ours, feeling just the same as when we hold the handles of a battery. Then the strength of the gentleman was wonderful, throwing us around the room as one would handle a toy. The whole evening was filled with these performances. There is no possible chance for deception, and those who have seen this say that the only motive power which these objects receive comes directly from the finger-tips of this man. He can perform the same feats in any room, or with any soft-pine table, which may be placed in any position."

E. W. HALL.

Waterville, Me., Oct. 7.

BOOK-REVIEWS.

Erster Nachtrag zur Bibliographie des Modernen Hypnotismus.
Von MAX DESSOIR. Berlin, 1890.

IN *Science* of June 22, 1888, will be found a notice of the original work to which the author now issues a supplement. The arrangement of the two contributions are practically the same, the

supplement including all that was published from May, 1888, to May, 1890. No more striking proof of the increase of interest in the subject of hypnotism could be furnished than the fact that this record of two years' work includes 382 titles of articles or books, written by 274 authors in 13 different languages, and appearing in 113 periodicals. Very interesting, too, is the variation in interest in different countries that has been going on in the last two years. In the former bibliography the French language was credited with 473 titles; English, with 102 (40 of which were American); Italian, with 88; German, with 69; and the rest scattering. In the supplement France still leads with 139, but Germany (probably in part including Switzerland) is a close second with 103; English comes next with 46 (24 of which are American); Italian following with 32.

The author has evidently done all in his power to render this bibliography useful and complete, and deserves great credit for carrying on this necessarily unpleasant work. He again asks for contributions and notices of works and articles bearing upon hypnotism, to be sent to R  thenerstr. 27 W., Berlin.

Guyot's Earth and Man. Revised edition. New York, Scribner.

THE republication of Guyot's famous lectures on "The Earth and Man" recalls a time which seems, in comparison with the wider opportunities of the present, to be a time of scientific awakening, and which is marked in contrast with this age of conventionalism as a time of scientific enthusiasm. In 1849, when Guyot gave these lectures in French at the Lowell Institute in Boston, the earlier geological surveys of our States were in progress or had but recently been completed. A great fund of fresh scientific information was published by them. Agassiz had come to this country a few years before, and was then about to gather around him the first of the band of students of natural history through whom he so greatly enlightened us. Lyceum lectures then held the place now taken by magazines, and public teachers were orators in the sight of their hearers, not writers hidden behind paper and print. Guyot's book is characteristic of that time. The several chapters retain to perfection the quality of enthusiastic discourses by a man full of his subject and devoted to it. It is doubtless for this charm of style, as well as for the interest of its matter, that the book has so long and deservedly been popular with geographic readers.

Two chief lines of thought run through the book. One is the importance of the vertical element,—the relief of the land; the other is the intimate relation between the conditions of the land and of its inhabitants. Concerning both of these aspects of geography we owe much to Guyot; but the "Earth and Man" hardly represents their present position. The more modern phase of geographic study accepts the importance that Guyot placed on relief, but adds the more direct consideration of local form and its evolution, to which Guyot gave but brief attention. The physical control of human conditions is as attractive a study as when Guyot brought it to us; but, with a fuller understanding of its complexities, we have come to be perhaps more cautious in our generalizations than he was. The modern writer might well hesitate before connecting the great area of our forests and the "melancholy, cold, and insensible" nature of our Indians in the relation of cause and effect.

As a book illustrating a well-marked epoch in our geographical literature, Guyot's "Earth and Man" should be placed in every school library; but, as a school-book for this end of the century, it cannot be highly regarded, although its publishers would seem to place it in that light. It does not appear to us to be true, as is claimed in a prefatory note to the book, that "the present edition of 'Earth and Man' has been revised in a few points affected by the progress of scientific knowledge since the appearance of the work." It would not be Guyot's "Earth and Man" if it were so revised. It would be a new book. Moreover, it possesses few of the qualities desired in a modern text-book. It is not demonstrative or disciplinary in its quality, and this because it accomplishes so precisely the intention of its author. It presents his glowing lectures as they were given; and as such, without significant revision, its republication is welcome.